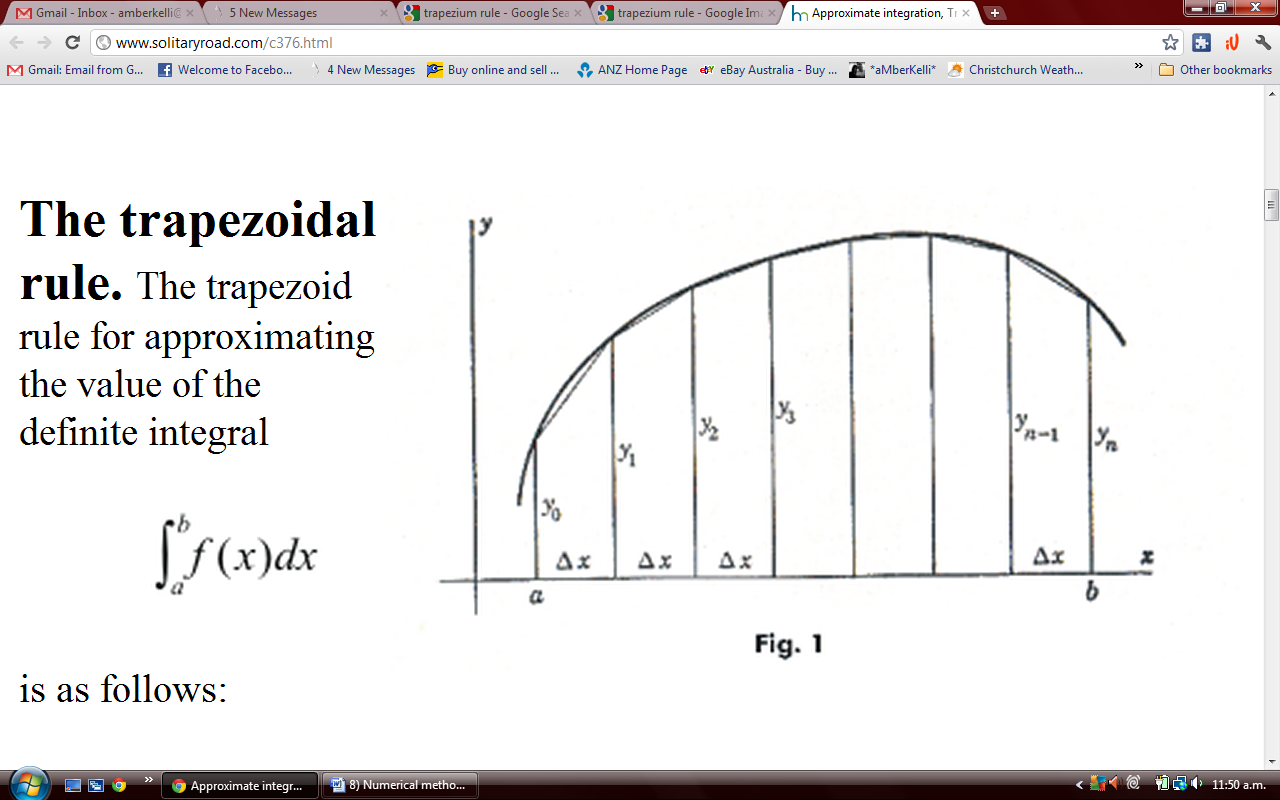
**8) NUMERICAL METHODS OF INTEGRATION**

We use numerical approximations to find the area under a curve that is not able to be integrated, or that we do not have a function to integrate - just a model or diagram.

A) **Trapezium rule**

The area required is divided up into small sections that are approximated to the shape of trapeziums. The areas of all the trapeziums are added together to find a total **approximate** area.

In general, the trapezium rule is:

Area =

last y-value

1st y-value

h

h

h

h

where = number of strips,

and = width of each strip

***Example***: Use the trapezium rule to obtain estimate for the value of using eight

strips.

Set up a table of the -values, use the TABLE function on the graphics calculator:

Go to TABLE.

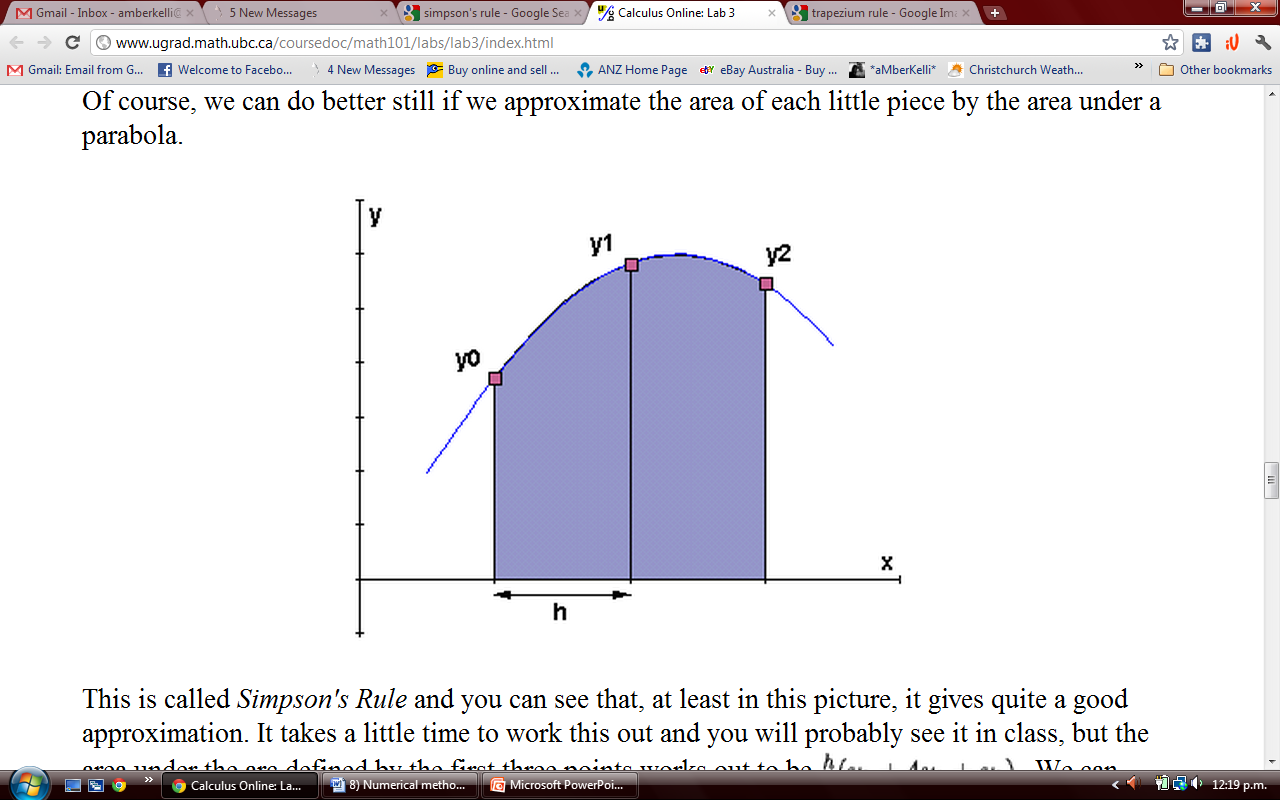
Type in the equation .

Press F5 for RANGE. Enter these values: Start = , End = , Pitch = .

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 2 | 2.5 | 3 | 3.5 | 4 | 4.5 | 5 | 5.5 | 6 |
|  | 4 | 4.167 | 4.5 | 4.9 | 5.333 | 5.786 | 6.25 | 6.722 | 7.2 |

Substitute into the trapezium rule formula:

units2 (1dp)

B) **Simpson’s Rule**

The Simpson’s rule uses parts of a parabola to fit

the shape of the curve. Each parabola passes through

3 points on the curve and has two regions below.

The number of -values substituted into Simpson’s Rule

must be **odd**, and the number of strips must be **even**.

Simpson’s Rule is:

All the odd y-values

All the even y-values

***Example***: Use Simpson’s Rule to approximate the area under the curve between

and using four strips.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 3 | 4 | 5 | 6 | 7 |
|  | 6 | 3 | 2 | 1.5 | 1.2 |

units2 (2dp)

Delta Ex 22.2 pg 207 Q1 – 5

Delta Ex 22.3 pg 211 Q1 – 5